

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SIXTH SEMESTER B.TECH DEGREE EXAMINATION (R), MAY 2023

FOOD TECHNOLOGY

(2020 SCHEME)

Course Code : 20FTT304

Course Name: Food Process Equipment and Design

Max. Marks : 100

Duration: 3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

1. Define the following terms: a) Creep b) Hooke's Law c) Resilience.
2. List out the general procedures for the equipment design.
3. A spherical vessel 3m diameter is subjected to an internal pressure of 1.5 N/mm². Find the thickness of the vessel required if the maximum stress is not to exceed 90 MPa. Take efficiency of the joint as 75%.
4. State Rankine's Theory and Airy equation.
5. Describe the working of a plate heat exchanger.
6. Calculate the Log Mean Temperature Difference (LMTD) of a countercurrent heat exchanger in which the milk enters at 35°C and leaves at 4 °C. The cooling water enters at 1 °C and leaves at 8.2 °C.
7. Describe the factors to be considered during design of cold storage.
8. Explain Cryogenic freezers.
9. Name any five equipments which is used in food industries based on the physical properties .
10. Define cleaning, grading, and sorting.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Substantiate the various theories to predict the failure of a material subjected to combined stresses. (10)
b) Explain the safety considerations in an equipment design. (4)

OR

12. a) List and discuss the different types of corrosion with suitable diagram and explaining the principle. (10)
b) Compare ductile and brittle materials in terms of engineering aspects. (4)

MODULE II

13. a) A cylindrical shell 4 m long, 1 m diameter and 12 mm thickness are subjected to an internal pressure of 1.2 N/mm². Calculate the a) longitudinal stresses, b) hoop stresses, c) change in diameter, d) change in length. (Take $E = 2 \times 10^5$ N/mm², $1/m = 0.3$) (10)
- b) Derive an expression for the hoop stress and longitudinal stress in a thin cylindrical shell. (4)

OR

14. a) Derive the Janssen's formula for calculation of lateral pressure induces by the granular materials against wall in deep bins. (14)

MODULE III

15. a) Discuss the important types of evaporators used in food processing industries with detailed diagrams. (7)
- b) Demonstrate the material balance for single and multiple effect evaporator with neat diagrams. (7)

OR

16. a) Briefly explain the design of Louisiana State University dryer with supporting figure. (7)
- b) Elucidate the design procedures for tray dyers industrially used. (7)

MODULE IV

17. A spherical product is being frozen in an air blast wind tunnel. The initial product temperature is 150 °C and that of cold air is -20 °C. The product has a 6 cm diameter with a density of 1050 kg/m³ & the convective heat transfer coefficient for the air blast is 75 W/m²K. The thermal conductivity for the frozen product is 1.1 W/mK, the initial freezing temperature is -1.8°C and the latent heat of fusion is 300 kJ/kg. Compute the freezing time. (14)

OR

18. a) With the help of neat diagram briefly explain the freezers used in food industries. (8)
- b) Elucidate the design parameters for freezers used in food industries. (6)

MODULE V

19. a) Explain the working and principle for different separator with supporting diagram. (10)
- b) Identify and describe an equipment that can separate the material from food grains according to length. (4)

OR

20. a) With the help of a schematic diagram explain the principle of working of a belt conveyer. (7)
- b) Compare screw conveyer and pneumatic conveyors with relevant diagrams (7)
